

## CLAIMS

### WHAT IS CLAIMED IS:

- 5 1. An apparatus for exposing only a selected portion of a length of optical fiber to a hydrogen atmosphere loading process, the apparatus comprising:
- a) a loading chamber that encloses at least the selected portion of the optical fiber and contains a hydrogen atmosphere; and
- 10 b) at least one heating element that regionally heats the hydrogen atmosphere surrounding the selected portion.
2. The apparatus of claim 1, wherein the heating element heats the hydrogen atmosphere to a temperature of at least 250 °C.
3. The apparatus of claim 1, wherein the loading chamber is a pressure chamber capable of containing a pressurized atmosphere.
- 15 4. The apparatus of claim 1, wherein the chamber is designed to contain pressures up to 3,000 psi.
5. The apparatus of claim 1, wherein the loading chamber encloses only the selected portion of a continuous length of optical fiber.
6. The apparatus of claim 1, wherein the loading chamber comprises a first tube
- 20 concentrically surrounding only the selected portion of the optical fiber.
7. The apparatus of claim 1, further comprising gas seals positioned at ends of the first tube, which contain the hydrogen atmosphere while allowing passage of the length of optical fiber.
8. The apparatus of claim 1, further comprising gas seals attached to end sections of the
- 25 selected portion of the optical fiber.
9. The apparatus of claim 1, further comprising cooling tubes attached to ends of the first tube, wherein the cooling tubes define cooling areas and the cooling tubes include seals that separate the cooling areas from the loading chamber.

10. The apparatus of claim 1, wherein the loading chamber comprises a vessel enclosing the entire length of optical fiber, wherein the heating member is positioned adjacent the selected portion of the optical fiber.
11. The apparatus of claim 1, further comprising a reel-to-reel arrangement, wherein end portions of the length of the optical fiber are wound on laterally spaced reels and the selected portion is suspended midspan.
12. The apparatus of claim 1, wherein the vessel is a pressure bell capable of containing high-pressure atmospheres.
13. The apparatus of claim 1 comprising a first and a second clamping vessel blocks, the vessel blocks having pockets that define the loading chamber when the vessel blocks are clamped together.
14. The apparatus of claim 1, further comprising cooling regions that cool portions of the fiber adjacent to the selected portion.
15. The apparatus of claim 1, further comprising a cooling region and a mechanism that moves the fiber from the loading chamber to the cooling region.
16. The apparatus of claim 1, wherein the mechanism comprises a movable magnet and a magnetic body attached to the fiber.
17. The apparatus of claim 1, further comprising a cooling region and a cooling device that regulates the temperature of the cooling region.
18. The apparatus of claim 1, further comprising a pre-heating chamber that is capable of heating the hydrogen atmosphere prior to introducing the hydrogen atmosphere into the loading chamber.
19. The apparatus of claim 1, wherein the heating element comprises a pre-heating chamber that is capable of heating the hydrogen atmosphere prior to introducing the hydrogen atmosphere into the loading chamber.
20. The apparatus of claim 1, wherein the heating element comprises a controllable heater within the loading chamber, wherein the heating element is placed adjacent to the location for the selected portion of the fiber.
21. The apparatus of claim 1, further comprising gas inlet and vent lines that can inject and vent the hydrogen atmosphere in the loading chamber.

22. The apparatus of claim 1, wherein at least one pressure seal adapted to help contain a hydrogen atmosphere within the loading chamber is physically affixed to the optical fiber.

23. The apparatus of claim 1, wherein the pressure seal comprises a curable elastomer.

5 24. The apparatus of claim 1, wherein the at least one pressure seal is located at a boundary between the selected portion of the optical fiber and a non-selected portion.

25. The apparatus of claim 1, further comprising at least one re-closable seal that is in contact with the optical fiber when the hydrogen atmosphere is contained in the loading chamber.

10 26. The apparatus of claim 1, wherein the at least one re-closable seal is located at a boundary between the selected portion of the optical fiber and a non-selected portion.

27. The apparatus of claim 1, wherein the at least one re-closable seal comprises an elastomeric collet.

15 28. An in-line apparatus for producing a grating in an optical fiber, comprising an optical fiber phosensitizing apparatus for selectively exposing only a selected portion of an optical fiber to a hydrogen atmosphere loading process, the apparatus comprising:  
a) a loading chamber that encloses at least the selected portion of the optical fiber and contains a high-temperature hydrogen atmosphere; and  
b) a heating region that locally heats the hydrogen atmosphere surrounding the  
20 selected portion to at least 250°C.

29. The apparatus of claim 1, further comprising a mechanism for advancing the selected portion of the optical fiber out of the loading chamber after loading has been completed.

25 30. The apparatus of claim 1, wherein the advancing mechanism permits advancing a second selected portion of the optical fiber into the loading chamber after loading of the selected portion has been completed.